



DEPTO. OFICINA TÉCNICA DE MANTENIMIENTO
GERENCIA DE S.TOR. GENERAL GEORGE

CARP. N° fs. 22
REF.: CEA-70270-5



6/10/75

INTERNATIONAL
GENERAL  ELECTRIC
COMPANY
INCORPORATED

SCHENECTADY
NEW YORK, U.S.A.

570 LEXINGTON AVE.
NEW YORK, U.S.A.

CONTRACT BETWEEN THE COMISION TECNICA
Y FINANCIERA DE LAS OBRAS HIDROELECTRICAS
DEL RIO NEGRO (RIONE), URUGUAY

AND
INTERNATIONAL GENERAL ELECTRIC COMPANY, INC.

This contract is entered into this 6th day of November, 1945 by the COMISION TECNICA Y FINANCIERA DE LAS OBRAS HIDROELECTRICAS DEL RIO NEGRO, URUGUAY, an official agency of the Uruguayan Government, hereinafter called the "Purchaser", and INTERNATIONAL GENERAL ELECTRIC COMPANY, INC., a company organized and existing under the laws of the State of New York, hereinafter called the "Contractor".

I - PURPOSE OF THE CONTRACT

ART. 1. The purpose of this contract is the design manufacture, supply, sale and delivery of Generator Units #3 and #4 for the Rio Negro project as defined and set forth in detail in the attached specification, dated September 1st 1945.

ART. 2. The obligations of the Contractor shall be governed by the provisions of this contract and the attached specifications.

ART. 3. The third and fourth generator units will be essentially duplicate of the first unit already supplied by the Contractor under contract dated January 8th, 1943 and the second unit now being supplied under extension #1 of the above contract dated July 25, 1944. In view of this no drawings need be submitted for approval except where it is agreed that minor details are to be changed, in which case the Contractor shall prepare and submit for approval four

blueprints of all drawings required by the change.

ART. 4. The Purchaser must either approve or disapprove the plans within a period of ten days. In case of disapproval, the Contractor shall without expense to the Purchaser make all the modifications necessary so that the equipment may be in accordance with the provisions and the intent of the specifications.

ART. 5. The approval of the drawings by the Purchaser or its designated representative does not imply the exemption of the Contractor from any part of its obligation to comply with all the requirements of the specifications, nor shall it in any way exempt from responsibility in connection with the correctness of the drawings.

ART. 6. The Contractor shall make in the drawings and specifications the changes which the Purchaser may demand if in the opinion of the Contractor such changes are not incompatible with the proper operation of the equipment but such changes shall be made at the expense of the Purchaser unless made pursuant to Article 4.

ART. 7. The action which, in accordance with the provisions of Articles 3, 4, 5, and 6, is incumbent upon the Purchaser or its designated representative shall be exercised by the Consulting Engineer of the Purchaser, such Consulting Engineer at present being the Harza Engineering Company of Chicago, Illinois, (hereinafter called the "Consulting Engineer").

ART. 8. If as a result of the changes mentioned in Article 6 there results an increase or decrease in the price of the equipment, the

contract shall be modified in writing by mutual agreement. However, the Purchaser may order, in case the parties do not agree on the change in price, that the manufacture of the equipment should not be withheld or delayed and the question concerning the changed price shall be decided by the Board of Arbitration in accordance with the provisions of Article 30 of this contract. In such case, if there is any increase, the payment provisions of this contract shall be changed to properly reflect such increase and to provide for such increase as if it had been included in the contract at the time of its signature.

ART. 9. The contractor shall supply to the Purchaser one Van Dyke negative, one photolithograph (reproduced tracing) and four blue-prints of each new drawing found necessary by Article 3.

II. - TIME OF DELIVERY

ART. 10. The Contractor shall have completed and ready for shipment from its factory, with all corresponding equipment hereby contracted:

Unit No. 3 on or before December 1946

Unit No. 4 on or before August 1947

ART. 11. If the Contractor refuses or fails to complete the equipment within the period of time specified in Article 10, in the absence of force majeure, the Purchaser may by written notice to the Contractor terminate this contract pursuant to the provisions of Article 27. The contract shall, subject to the provisions of Articles 28 and 29 be extended for causes of force majeure which are defined as any unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to Acts of God or of the public enemy, acts of the Govern-

ment (including but not restricted to any preference, priority or allocation order or the lack of such order), acts of another contractor in the performance of a contract of the United States Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, delays on the part of the Purchaser or its representative in carrying out inspection and tests or in approving the drawings, or because of changes requested by the Purchaser pursuant to Article 6, or delays of subcontractors due to such causes.

ART. 12. The Contractor shall prepare and supply to the Purchaser 4 copies of a completion schedule showing a breakdown of the complete equipment into its various shipment units, showing the approximate dimensions and weights and the respective dates on which it is estimated units will be completed and ready for shipment from the factory. In the preparation of the said list, the Contractor shall take into consideration the order, in which the parts of the equipment will be necessary for the normal assembly (erection) of same in Uruguay. The Contractor shall give immediate advice to the Purchaser, in writing, in triplicate, of any delay which may be expected in connection with the dates set forth in the said completion schedule, explaining the reason for such delay.

ART. 13. In order to facilitate the steps to be taken in connection with the shipment by the Purchaser, the Contractor shall deliver in triplicate to the Consulting Engineer, once every month, namely about the first of each month, a report on the progress made. This report shall show the status of completion of the major items of the

various assembled equipment and the completion schedule, including packing, for such items. Separate reports shall be issued for Unit #3 and Unit #4.

III. - EXTRAS

ART. 14. If the Purchaser should order any extra or additional equipment from the Contractor and should specify this in a written order accepted by the Contractor, such extra or additional equipment shall be supplied by the Contractor in accordance with the terms and conditions contained in this contract. The Purchaser shall take the necessary steps for the payment of same under conditions similar to the conditions provided for in this contract.

IV. - INSPECTION AND TESTS

ART. 15. Unless otherwise agreed all equipment and workmanship shall be subject to inspections and tests by such agency of the United States Government as may be selected by mutual agreement between the United States and Uruguayan Governments. The representative of such agency of the United States shall in making such inspection be deemed to be acting on behalf of the Purchaser and the selection of the agency to conduct such inspection shall be arranged by the Purchaser or its Government with the United States Government. The Purchaser may reject equipment which contains defective material or workmanship as advised by the inspectors of the United States agency selected and in case of such rejection the Contractor shall correct the defect or replace the defective part at its own cost. The expense of such inspector shall not be for the account of the Contractor;

but the Purchaser may charge to the Contractor the actual additional cost, if any, of such inspector's time, living and traveling expenses incurred in connection with such inspection should any equipment in respect to which notification of readiness for inspection has been given not be ready for inspection at the time specified by the Contractor.

ART. 16. Inspection and tests shall be made in such manner as not to interfere with or retard manufacture of the equipment.

ART. 17. The representative designated by the Export-Import Bank of Washington shall be permitted to inspect the progress of the manufacture of the equipment included in this contract if required.

ART. 18. The Contractor will permit the Purchaser's representatives (not more than two at any one time) to visit its factories from time to time to the end that they may become familiar with the equipment to be supplied hereunder for the purpose of enabling them to install, operate and maintain the equipment at the site of its installation - all subject to permission for such visits being obtained by the Purchaser from the necessary authorities in the United States.

ART. 19. The inspection does not exclude the responsibility specified in Article 26 of the Contractor.

V. - RESPONSIBILITY FOR LOSSES, DAMAGES
AND DETERIORATION

ART. 20. The Contractor is responsible for any losses, damages and deteriorations which may occur in connection with the equipment up to delivery FAS vessel New York irrespective of the cause thereof. Beginning with the moment of delivery the Purchaser shall bear such

responsibility. However, the responsibility of the Contractor shall continue for any losses which are the consequence of errors or defects of material, workmanship, packing and/or operation in accordance with what is specified in Article 26.

VI. - PRICE

ART 21. For the complete equipment delivered FAS vessel New York the Purchaser shall pay the price of \$800,000.00, Legal Tender of the United States of America.

ART. 22. This price shall be paid as follows:

5% of the total purchase price, namely, the amount of \$40,000. within twenty days from the signing of this contract.

Separate progress reports will be issued for each generator unit and the following payments will be made for each unit, the percentage applying to the pro rata price for each unit, namely, \$400,000.00.

15%, namely, the amount of \$60,000. after 25% of the work on Unit #3 has been done.

15%, namely, the amount of \$60,000. after 25% of the work on Unit #4 has been done.

20%, namely, the amount of \$80,000. after 50% of the work on Unit #3 has been done.

20%, namely, the amount of \$80,000. after 50% of the work on Unit #4 has been done.

20%, namely, the amount of \$80,000. after 75% of the work on Unit #3 has been done.

20%, namely, the amount of \$80,000. after 75% of the work on Unit #4 has been done.

30%, namely, the amount of \$120,000. upon delivery of Unit #3 FAS vessel New York or substitute delivery specified in Article 36.

30%, namely, the amount of \$120,000. upon delivery of Unit #4 FAS vessel New York or substitute delivery specified in Article 36.

10%, namely, the amount of \$40,000 after 12 months of successful operation in Uruguay of Unit #3 but in any event within 24 months after the due date of the 30% payment.

10%, namely, the amount of \$40,000. after 12 months of successful operation in Uruguay of Unit #4 but in any event within 24 months after the due date of the 30% payment.

ART. 23. The price to which reference is had in the foregoing Article 21 shall be decreased, in case it should exceed either in whole or in part the maximum price fixed by the Government of the United States, to such an extent that such maximum price shall not be exceeded.

VII. - CERTIFICATE OF PAYMENT

ART. 24. The 15% and 20% payments specified in Article 22 shall be made against presentation of work progress certificates issued by the inspectors appointed pursuant to Article 15. The 30% payments shall be made against presentation of dock receipt, inland bill of lading, storage or warehouse receipt or other evidence of shipment or delivery. The 10% payments shall be made against presentation of certificate of successful operation issued and signed by the Purchaser, which will be issued after 12 months of successful operation, but such 10% payments shall be due and payable in any event within 24 months after the due date of the 30% payment, it being understood however that if at the expiration of such 24 months, the equipment does not comply with the warranties specified in Article 26 then said 24 months will be extended until the Contractor completes such changes as may be necessary for such compliance. To the extent that any document to be issued by the Purchaser or his representative

is required to be presented for any payment under this contract, there can be substituted for such document an arbitration award rendered by the Board of Arbitrators pursuant to Article 30 stating that the Contractor is entitled to receive such document.

VIII. - LETTER OF CREDIT

ART. 25. In order to provide for the payments to be made by the Purchaser hereunder, the Purchaser shall cause to be confirmed in favor of the Contractor by the National City Bank of New York within 20 days after the signing of this contract, an irrevocable letter of credit in United States Dollars to be available in conformity with the terms of payment provided in Article 22 with respect to the 5% payments, the 15% payments the 20% payments and the 30% payments, and the letter of credit shall also include terms in conformity with Articles 28 and 29 in the event of cancellation of this contract pursuant to the provisions of said Articles 28 and 29. Such letter of credit shall cover 90% of the purchase price of the equipment included in this agreement. Simultaneously, a second letter of credit with the same bank will be confirmed for 10% of the purchase price available up to December 31, 1948, as security for the final payments. This second letter of credit shall be established upon terms in conformity with the terms of payment specified in Article 22 for the final 10% payments and shall also include terms in conformity with Articles 28 and 29 in the event of cancellation of this contract pursuant to said articles. In the event that all payments under the two letters of credit have not been completed 10 days prior to the date of their expiration, then the periods of such letters of credit

shall be extended for such further periods as may be mutually agreed upon. If such letters of credit have not been extended upon their expiration dates the issuing bank shall draw the unpaid balance of each of such letters of credit and shall place the amounts of such balances in a special deposit account to be made available to the Contractor against presentation of the same documents as provided in the letter of credit (a) until such time as the Contractor and the Purchaser shall jointly notify said bank that all payments under the contract have been effected, (b) or until such time as the Board of Arbitration by an award rendered pursuant to Article 30 shall determine that cancellation pursuant to Article 27 has become effective, or (c) until such time as the Board of Arbitration by an award rendered pursuant to Article 30 shall determine that all payments to the Contractor pursuant to Article 29 have been completed in case cancellation takes place pursuant to such Article 29, on the occurrence of either of which events any balance still remaining in said special deposit account shall revert to the Purchaser.

IX. - WARRANTIES

ART. 26.

(a) The Contractor declares and warrants that:

(1) The material, the workmanship, the manufacture, construction and assembly of the equipment shall be first class in every detail.

(2) The equipment, once constructed and assembled at the plant of the Purchaser, shall constitute a complete and efficient operating unit with an operating capacity on a commercial scale at

the rate and capacity established in the attached specifications if it is assembled under the supervision of the Engineer of the Contractor as provided for in Article 35.

(3) The equipment to be supplied in accordance with this contract including all extras by virtue of Article 14 will comply in every regard with the attached specifications and with the specifications for any of such extras and with the representations and warranties herein established.

(b) The Contractor for his own account, shall repair promptly or shall replace FAS vessel New York with freight and ordinary marine insurance allowed to Montevideo, upon the written request of the Purchaser, any material or part comprising such equipment.

- (1) Which does not comply with the specifications; representations or warranties herein established; or
- (2) Which may be of incorrect or defective design; or
- (3) Which, in normal proper use or operation and proper maintenance, may show defects of workmanship or materials, appearing within a period of 12 months from the date of which the equipment was placed in commercial operation for the first time at the plant of the Purchaser, but in no case shall such period of time exceed 24 months from the date on which the equipment was ready for shipment from the factory, it being understood that such period of 12 months and such period of 24 months shall be extended for a period of time equivalent to the time during which the equipment is out of operation after the installation of same, as a result of the defects of the material or workmanship used in its manufacture unless this period of 24 months has expired before its operation.

X - CANCELLATION

ART. 27. In case the Contractor has not completed the manufacture of the equipment in accordance with Article 10, and providing that such failure to complete is due to causes other than force majeure as defined herein or acts of the Purchaser its representatives or Consulting Engineer, the Purchaser may at any time thereafter cancel this contract by written notice to the Contractor except for failure to complete such parts of the equipment which can be completed at a later date without delaying the installation and operation of the equipment. In case of such cancellation the Contractor agrees to return to the Purchaser the amounts paid hereunder, except to the extent that the Purchaser retains delivered equipment. As to equipment delivered to the Purchaser the Purchaser shall have the right (a) to retain the same in which case any unpaid accounts applying thereto shall become due and payable or (b) to return such delivered equipment to the Contractor in the same condition in which it was delivered to the Purchaser upon which return the Purchaser shall be entitled to the return of any moneys paid by it to the Contractor as to such returned equipment. The foregoing represents the entire liabilities of the parties hereto in case of cancellation under this Article 27.

ART. 28. In case completion of the equipment does not occur within the terms of Article 10 and providing such failure to complete is due to force majeure as herein specified then there shall be an additional extension for the period of the existence of such force majeure under the following conditions:

- (a) If any of such completion dates is extended for a period of

six (6) months, by reason of acts of the public enemy of the United States of America, or by acts of the Government of the United States of America or any agency thereof, then the purchaser reserves the right at any time thereafter to cancel this contract by written notice to the contractor on the following basis:

(1) The Purchaser shall pay to the Contractor the full purchase price for such of the equipment as has been delivered in accordance with the terms hereof and also for such of the equipment as has been completed in accordance with the terms hereof but not yet delivered.

(2) The Purchaser shall pay to the Contractor all expenses incurred by the Contractor in the partial performance of the contract to which such cancellation applies (except expenses in connection with completed equipment) including all labor and material costs, liquidation of commitments, and all other items of expense with respect to such partially completed equipment in accordance with the standard accounting practice of the Contractor.

(3) In case of cancellation under this Article 28 and upon payment of the amount specified in (1) and (2) of this Article the partially completed equipment shall become the property of the Purchaser but at the option of the Purchaser expressed in its notice of cancellation the Contractor shall retain title to such partially completed equipment and will determine in accordance with its standard accounting practice the salvage value of such partially completed equipment and will deduct such salvage value from the amounts payable by Purchaser pursuant to (1) and (2) of this Article 28.

(b) If the equipment is not completed in accordance with terms

of Article 10 for reasons of force majeure as herein defined other than by acts of the public enemy of the United States of America or by acts of the Government of the United States of America or any agency thereof, then unless otherwise agreed the Contractor shall, to the extent that its own facilities for the manufacture of such partially completed equipment are or will not be available within a reasonable period of time, and to the extent that adequate and competent manufacturing facilities of other manufacturers in the United States are available for such purpose, sub-contract with such other manufacturers, for the manufacture of all or a part of such unfinished equipment to the extent that arrangements can be made with such other manufacturers, and it is agreed that such subcontracting shall not increase the price to the purchaser of the equipment included herein.

ART. 29. The Purchaser reserves the right to cancel this contract by written notice to the Contractor at any time in whole or in part by paying to the Contractor the following amounts:

(a) The full purchase price of all such parts of the equipment as are completely manufactured, either delivered or undelivered.

(b) All expenses incurred by the Contractor in the partial performance of this contract to which such cancellation applies (except costs in connection with completed equipment) including all labor and material costs, liquidation of commitments, and all other such items of expense as to such partially completed equipment as may be determined in accordance with the Contractor's standard accounting

practices, and in the event that parties hereto are unable to agree upon the amount of such expenses, the same shall be determined by arbitration pursuant to provisions of Article 30 hereof.

(c) 10% of an amount arrived at by subtracting from the total contract price of the equipment included in this contract the amount paid pursuant to paragraph (a) of this Article 29.

(d) In case of cancellation under this Article 29 and upon payment of the amounts specified in (a) (b) and (c), the partially completed equipment as well as the fully completed equipment shall become the property of the Purchaser but at the option of the Purchaser expressed in its notice of cancellation the Contractor shall retain title to such partially completed equipment and will determine the salvage value of such partially completed equipment in accordance with the Contractor's standard accounting practice and shall deduct from the amounts payable by the Purchaser pursuant to (a), (b) and (c), the salvage value of such partially completed equipment as so determined.

XI. - ARBITRATION

ART. 30.

(a) Any controversy, claim, dispute or difference arising out of or relating to this contract shall be settled by arbitration by three (3) arbitrators, one (1) appointed by each party and a third by mutual agreement by the two thus appointed. If either party shall fail or neglect, within a period of fifteen (15) days after written notice by the other, to appoint an arbitrator, then and in that event the arbitrator for such party shall be appointed by the Chief Justice of the Supreme Court of the United States, but if he fails to appoint

an arbitrator within (10) days then the arbitrator shall be appointed by such officer of the Government of the United States as may be mutually agreed upon between the parties, but if such officer is not mutually agreed upon within ten (10) days or if after being appointed he fails within (10) days to appoint the arbitrator then the President of the American Society of Mechanical Engineers or the President of the American Institute of Electrical Engineering, provided the appointing officer is not connected with the interested companies, shall appoint the arbitrator. If the two arbitrators appointed by the parties fail or neglect, within a period of fifteen (15) days after the appointment of the last arbitrator so appointed, to agree upon the third arbitrator, then such third arbitrator shall be appointed as above provided for the appointment of a second arbitrator where one of the parties fails to appoint its arbitrator. The arbitration shall be held in the City of New York except as provided in paragraph (b) of this Article. The decision of the arbitrators shall be by majority and shall be binding upon both parties and the expense of the arbitration shall be divided as the arbitrators may determine.

(b) In case any controversy, claim, dispute or difference should arise as the result of the operation of the equipment in Uruguay, the arbitration shall take place as specified in (a) except that in case the two arbitrators fail or neglect to appoint the third arbitrator within the time specified in (a), such third arbitrator shall be appointed by the Supreme Court of Justice in Uruguay.

XII. - PATENTS

ART. 31. In case any lawsuit, claim, complaint, action or litigation

is instituted on the ground that the equipment or part of the equipment supplied by the Contractor constitutes an infringement of a U.S.A. patent, the Contractor shall defend for his own account all and any such demands, complaints, actions or litigation and shall pay all damages and costs assessed by the Courts against the Purchaser. If the Purchaser should be prevented at any time from using any of the said equipment or parts thereof due to any infringement of any patent of the U.S.A., the Contractor shall secure for the Purchaser promptly and for its own account, the right to continue using such equipment or parts thereof or shall replace same for its own account with other equipment not infringing upon any patent and which must comply satisfactorily with all requirements of this contract. The Contractor may at any time for its own account replace the equipment or parts thereof concerning which any claim of infringement of any U.S.A. patent has been submitted, by equipment or parts not infringing upon patents and complying with the requirements of this contract, or assume and conduct the defense of any law suit, action or litigation of this kind for its own account, provided that during the defense of such law suit, action or litigation the operation of the plant of the Purchaser is not unduly interrupted by reason of a permanent restricting order or injunction or by any provisional order or injunction which is not set aside within a reasonable period of time. The Purchaser shall have the right to retain for his own account a lawyer selected by him in order to assist in the defense of such claim, action, proceeding or litigation.

The Purchaser shall promptly advise the Contractor of such complaint, action, law suit or proceeding in writing, authorizing it

and giving it all available information and assistance (for the account of the Contractor) for the proper defense thereof.

The Contractor shall in no case be responsible for any agreement or settlement entered into without its written consent. The Purchaser shall assume full responsibility for the infringement of any Uruguayan patent by the equipment or the use thereof in Uruguay, the Contractor being responsible only up to the limit herein indicated for the infringement of U.S.A. patents.

XIII. - TRANSFER

ART. 32. The Contractor may not transfer this contract or the corresponding order, in whole or in part, without the written consent of the Purchaser. This provision shall not prevent the Contractor from subcontracting. Even though this transfer is agreed to by the Purchaser, the Contractor shall continue to be responsible for the performance of this contract.

XIV. - MARITIME SHIPMENT

ART. 33. The Purchaser or its appointed representative shall engage shipping space on available vessels with destination to Uruguay which are to sail on the nearest date after the respective dates on which the shipping units are ready for shipment. The Contractor shall fully cooperate with the maritime agent appointed by the Purchaser or its representative, trying to facilitate and assure the shipment in sufficient time in accordance with the conditions which may prevail from time to time so that the equipment may arrive at the port of shipment reasonably ahead of the date of the scheduled sailing indicated by the Maritime agent of the Purchaser.

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The Contractor shall supply to the maritime agent of the Purchaser all the data necessary as to weight and dimensions of the equipment prepared for shipment, and shall prepare and supply all the commercial invoices, cooperating with the Purchaser for the obtaining of all the other documents which may at times be necessary so that the maritime agent of the Purchaser may effect the shipment. The markings and the shipment shall be made in accordance with the instructions to be supplied by the Purchaser or its appointed representative. The equipment shall be packed, boxed or crated for under-deck ocean shipment in accordance with the standard practice of the manufacturer.

XV. - TAXES

ART. 34. Any sales, excise or manufacture tax (other than taxes on income or profits) or any increase in any such tax imposed by the Government of the United States, or any other state, municipality or any subdivision thereof, subsequent to the signature of this contract, will be for the Purchaser's account, to the extent that the law of the Contractor's country permits. The Purchaser shall be liable for the payment of all taxes imposed in connection with this equipment by Uruguay or any state, municipality or sub-division thereof.

XVI. - ERECTION

ART. 35.

(a) The Contractor shall supervise through a duly qualified erection engineer, the erecting, installation and placing in operation of the equipment in the hydroelectric works of the Rio Negro in Uruguay. The Purchaser shall pay for the services, traveling ex-

penses and other expenses from the time the erection engineer leaves the Contractor's factory until his return to same after completion of the work - these amounts not to exceed those specified in the following sub-paragraphs.

(b) The Purchaser shall pay for the services of the said erection engineer at the rate of \$25.00 U.S. Currency per day, from the time he leaves the factory of the Contractor until his return to same. It must be understood that for services exceeding 48 hours per week the rate shall be time and one half of the normal rate and for Uruguayan holidays and Sundays the rate shall be twice the regular rates. The rates for the payment of the service of said engineer during the time of travel shall in no case exceed U.S. \$25.00. The Purchaser shall pay the following expenses incurred in connection with the services of the erection engineer:

(1) First class travel and reasonable expenses of maintenance from the time the erection engineer leaves the factory of the Contractor where he works until his arrival at Rincon del Bonete, Uruguay, and also first class travel and reasonable expenses for maintenance of the erection engineer from the time he leaves Rincon del Bonete until his arrival at the said Contractor's factory and while he travels in the performance of his duties for the Purchaser. The trips from the United States to Uruguay and return may be made either by vessel or by airplane, at the option of the Contractor.

(2) The Purchaser shall pay for or provide suitable lodging at the place of work and shall also provide board as long as the engineer is at such place or shall pay for such board at a rate not exceeding 6 Uruguayan Pesos per day.

(3) Any taxes or charges which are imposed in accordance with the laws and regulations of Uruguay due to the services of such erection engineer, by virtue of these presents.

(4) Any expenses of the said erection engineer other than those specified shall be for the account of the Contractor.

(c) The hours of work required of the erection engineer shall agree in general with the standard working hours for employees of the same class as that of the said engineer doing similar work in Uruguay. As it is not possible for a single supervising engineer to observe in detail all the operations carried out by the working men, the Contractor shall not be responsible for acts of, or damages to working men, for damages to property or for injuries to third parties, or for extra expenses incurred in the erection or for damages due to unavoidable causes or other causes of force majeure.

(d) It must be understood that the erection engineer's time sheets shall be submitted to the Purchaser for approval.

(e) The invoices for services and expenses of the erection engineer shall be submitted monthly and shall be paid within a period of 30 days from the date of the invoices. The payment shall be made in New York funds at the Office of the Contractor in New York.

(f) The Purchaser shall advise the Contractor when the erection engineer shall be required and he shall also advise the Contractor and the Erection Engineer when the services of the latter are no longer required. During the period of time during which the said engineer is in Rincon del Bonete in the performance of his duties, he shall cooperate with the engineers of the Purchaser and with the engineers employed by other suppliers who may be present at the place

of the work at the same time as he.

XVII. - STORAGE

ART. 36. In case shipment from the factory or delivery FAS vessel New York cannot for any cause beyond the Contractor's control be made after the equipment is completed and ready for shipment or delivery, the Contractor upon ten (10) days written notice to the Consulting Engineer shall have the right to place the equipment in storage at its factory or elsewhere for the purchaser's account and risk, provided, however, that transportation charges to the site of storage will be for the Contractor's account. The Purchaser shall have the right to designate the place of storage other than Contractor's factory for such equipment, provided (a) it is located in Continental United States east of the Mississippi, and (b) that there are suitable railroad facilities to the place of storage and suitable handling facilities at the place of storage, and in such case the Contractor will, if requested by the Purchaser, advise as to the suitability of such storage. Any charges for such storage, including in and out charges, and insurance, if placed, shall be paid by the Purchaser upon submission of invoices therefor, it being provided, however, that the Contractor shall pay such storage charges for a maximum period of thirty (30) days. Such delivery into storage shall complete the Contractor's delivery obligations hereunder, and shall be deemed the full equivalent of delivery FAS vessel New York for payment and all other purposes under this contract. Any expenses for movement of the equipment thereafter shall be for Purchaser's account.

XVIII. - CONSEQUENTIAL DAMAGES

ART. 37. In no event will the Contractor be liable for consequential

damages as a result of warranties, patent infringement or otherwise, except as herein otherwise specifically provided.

XIX. COMMUNICATIONS

ART. 38. Any communications, drawings or information which must be sent to the Purchaser or his representative by virtue of these presents shall be sent by mail, telegraph or cable, addressed as follows:

Comision Tecnica y Financiera de
las Obras del Rio Negro (RIONE)
c/o Harza Engineering Company
205 West Wacker Drive
Chicago, Illinois

Any communications, drawings, or information to be sent to the Consulting Engineer by virtue of these presents shall be sent to him by mail, telegraph or cable, addressed as follows:

Harza Engineering Company
205 West Wacker Drive
Chicago, Illinois

Any communications, drawings, or information to be sent to the Contractor by virtue of these presents shall be sent to it by mail, telegraph or cable addressed as follows:

International General Electric Co., Inc.
1 River Road
Schenectady, N.Y.

IN WITNESS WHEREOF, each of the parties has had this instrument signed by its duly authorized officials.

Place and date of
Signature:
Chicago, Illinois
November 6, 1945

COMISION TECNICA Y FINANCIERA DE LAS
OBRAS HIDROELECTRICAS DEL RIO NEGRO

BY (Signed) L. Cagno
(Under Power of Attorney)

~~/// (Under Power of Attorney) ///~~

Place and date of
Signature
570 LEXINGTON AVENUE
NEW YORK CITY
OCT. 11, 1945

INTERNATIONAL GENERAL ELECTRIC CO.,
INC.

BY (Signed) E. F. Callahan
Vice President

Specifications
for
GENERATOR UNIT #3
and
GENERATOR UNIT #4
* * *
RIO NEGRO DEVELOPMENT
for
RIONE, MONTEVIDEO, URUGUAY

Harza Engineering Co.
205 West Wacker Drive
Chicago, Illinois

September 1st 1945

I N D E X

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ENGINEERING SPECIFICATIONS

GENERATOR

1. WORK INCLUDED. The equipment contained in this contract is two vertical shaft, water wheel driven alternators with direct connected main and pilot exciters, air coolers, regulating equipment etc., all as detailed hereinafter and to be essentially duplicate of Units #1 and #2 already supplied by the contractor.

2. CONTRACT DRAWINGS, ETC. Drawings showing arrangements and details of the generator base plates as now installed for the stator and lower bearing bracket will be provided to the Contractor by the Purchaser. The Contractor shall so arrange and design the work to be furnished by him that it shall fit the installed work and shall be readily attached thereto as necessary or required, subject to correctness of information furnished to the Contractor as to exact details and dimensions of the embedded parts.

3. MATERIALS. All materials used in the construction of the apparatus shall be selected as the best available for the purpose for which used, considering strength, ductility, durability and best engineering practice, and shall conform to the latest applicable specifications of the American Society for Testing Materials. The Contractor shall submit to the Consulting Engineer, for approval, a list of types and grades of materials he proposes to use for the following parts of the apparatus, before proceeding with manufacture:

- (a) Generator shaft
- (b) Rotor - {rim
 hub
- (c) Poles - {end plates
 punchings

- (d) Thrust bearing runner plate
- (e) Lower bearing bracket
- (f) Cooler tubes
- (g) Bolts

Liberal factors of safety shall be used throughout the design and especially in the design of all parts subject to alternating stresses or shock. For the rotating parts of the generator and exciter, the maximum unit stresses due to runaway speed shall not exceed two-thirds of the yield point. For all parts of the apparatus when subjected to maximum normal operating conditions, the unit stresses in the materials shall not exceed the values in the following table:

	Maximum unit stress in pounds per square inch	
	<u>Stress in tension</u>	<u>Stress in Compression</u>
Cast Iron	2,000	10,000
Cast Steel	10,000	10,000
Alloy Cast Steel	20 percent of the ultimate strength or 33 percent of the yield point	20 percent of the ultimate strength or 33 percent of the yield point
Plate Steel	12,000	12,000

For other materials used in the construction of the apparatus, the maximum stresses due to the most severe normal operating conditions shall not exceed one-third of the yield point nor one-fifth of the ultimate strength of the material.

The Contractor shall, upon request of the Consulting Engineer, furnish complete information as to the maximum unit stresses used in

the design.

Tests. The materials used in the manufacture of the parts of the apparatus hereinbefore listed shall be tested in accordance with the details thereof in the applicable specifications. The Contractor shall furnish the Consulting Engineer with certified copies of reports of tests of the materials, in such form as to provide means of determining compliance with the specifications.

The cost of making all of the above required tests shall be borne by the Contractor. The Consulting Engineer shall have the right to select additional test specimens of any of the materials to be used and to make tests of the same, at the expense of the Purchaser.

Purchase Orders. Two copies of all purchase orders, showing firm names and addresses and list of material, shall be furnished the Inspector as soon as issued, and immediate notice shall be given him of the receipt of any material for the work, together with detailed lists of the same. Orders shall be so worded or marked that each item may be identified in the plans for the work.

4. ELECTRIC WELDING - FUSION TYPE

(a) Preparation for Welding. Members to be joined by welding shall be cut accurately to size and, where required, shall be rolled or pressed to the proper curvature in accordance with dimensions shown on the drawings. The edges of the members shall be sheared, flame-cut, or machined to suit the required type of welding and to allow thorough penetration. The cut surfaces shall expose sound metal free from laminations, surface defects caused by shearing or flame-cutting operations, or other injurious defects. The surfaces of plates to be welded shall be free from rust, grease and

other foreign matter for a distance of at least one-half of an inch back from the edge of the weld.

(b) Welding. All welding shall be performed by the electric-arc method, by a process which will exclude the atmosphere from the molten metal, and where practical, under procedure control using automatic machines. After being deposited, welds shall be cleaned of slag and shall show uniform sections, smoothness of weld metal, feather-edges without overlap and freedom from porosity and clinkers. Visual inspection at the edges and ends of welds shall indicate good fusion with the base metal. Particular care shall be taken in aligning and separating the edges of members to be joined by butt welding, so that complete penetration and fusion at the bottom of the joint will be assured. All pinholes, cracks and other defects shall be repaired by chipping or grinding the defects to sound metal and re-welding. Where fillet welds are used, the members shall fit closely and shall be held together during welding. The welding rods used for manual welding shall be of the heavily coated type and shall be suitable for all-position welding where required.

(c) Welding Process. The Contractor shall have established and recorded a specification of the welding process that he proposes to use and, if required, shall furnish to the Consulting Engineer a copy of such process specification, together with certified copies of reports of results of tests made in accordance therewith. The qualification of the welding process shall be in accordance with the "Standard Qualification Procedure" of the American Welding Society, and the minimum requirements of the tests shall be as stated in the appendix to said "Standard Qualification Procedure."

(d) Qualification of Welders. All welding operators assigned to the work shall have passed the qualification test for welding operators as specified in the "Standard Qualification Procedure" of the American Welding Society, and the minimum requirements of the tests shall be as stated in the appendix to the above-mentioned rules. If at any time, in the opinion of the Consulting Engineer, the work of any operator appears questionable, such operator will be required to pass additional qualification tests to determine his ability to perform the type of work on which he is engaged. All such requalification tests for welding operators and the physical tests of the welded specimens shall be made in the presence of the inspector. The Contractor shall furnish all test plates and all welding electrodes required for making the qualification tests. The test plates shall be of the same material as that to be used in the work; the edges shall be grooved or beveled where required, and the technique of welding shall be the same as to be used in the work. The welding electrodes shall be of the same size, type, and brand of manufacture as those to be used in the work. If required, the Contractor shall furnish to the Consulting Engineer certified copies of reports of the results of physical tests of specimens welded in the qualification tests. All expense in connection with making the qualification tests for welding operators shall be borne by the Contractor.

5. WORKMANSHIP. All work shall be done and completed in a thorough, workmanlike manner and shall follow the best modern practice in the manufacture of high-grade machinery, notwithstanding any omissions from these specifications. All work shall be done by

mechanics skilled in their various trades. All parts shall be made accurately to standard gauge when possible so as to facilitate repair and replacement.

6. COOPERATION WITH OTHER CONTRACTORS. The generator contractor shall exchange, with the turbine contractor, all necessary drawings, dimensions, templates, gauges and other information required to insure the complete and proper design and manufacture of all connecting or related parts of the turbine, governor and generator. No extra compensation shall be claimed because of any modifications required to accommodate equipment of another contractor, except as is otherwise specifically provided herein. All adjustments shall be made between the respective contractors without involving extra cost to the Purchaser. Two copies of all drawings and all correspondence relating to drawings and specifications interchanged between contractors shall be sent to the Consulting Engineer.

7. TYPE AND RATING. The generator to be furnished under these specifications shall be of the vertical shaft, waterwheel driven type, with thrust and guide bearings, direct-connected main and pilot exciters, voltage regulator, rheostats, and a closed system of ventilation with surface air coolers. The rating of the generator shall be as follows:

- (a) Capacity, kva 32,000
- (b) Power factor, lagging 0.95
- (c) Frequency, cycles 50
- (d) Number of phases 3
- (e) Voltage between phases, rated . . 13,800
- (f) Speed, normal, r.p.m. 125

- (g) Stator winding connection Star, suitable both for grounded or ungrounded operation.

Rating, tests and characteristics shall be in accordance with the latest approved standards of the American Standards Association, American Institute of Electrical Engineers, and the National Electrical Manufacturers Association, each as they apply, unless otherwise definitely specified.

8. TEMPERATURE RISE

(a) The maximum temperature rise of both the armature and field windings shall not exceed 60 degrees C. when delivering full rated output continuously at normal voltage, power factor, and frequency, and with cooling air entering the generator at not more than 40 degrees C. The temperature of the armature windings will be determined by means of embedded, resistance type temperature detectors, located in the armature winding in accordance with American Standard Association Rule 3,080. The temperature of the field winding will be determined by the resistance method.

(b) The generators shall also be capable of delivering 115 percent rated kva continuously at rated voltage, power factor, and frequency, without exceeding 80 degrees C. above 40 degrees C. ambient.

9. ELECTRICAL CHARACTERISTICS. The electrical characteristics shall be as follows:

- (a) Guaranteed unsaturated direct-axis transient reactance, not greater than, percent 35
- (b) Short circuit ratio, not less than . . 1.2

- (c) No-load balanced telephone interference factor, not greater than . 50
- (d) No-load residual telephone interference factor, not greater than . 30
- (e) Deviation factor of wave form, measured in percent from line to line on open-circuit at rated voltage and frequency, not more than. 10
- (f) Efficiency at 32,000 kva, 1.0 power factor, not less than, percent . . 97.0
- (g) Nominal exciter response ratio, not less than 0.5

10. MECHANICAL CHARACTERISTICS. The generator shall have the following mechanical characteristics:

- (a) Flywheel effect (WR2) of rotating parts of generator and exciters, not less than, pound feet squared. 36,000,000
- (b) Direction of rotation Counter-clockwise
- (c) Maximum runaway speed, r.p.m.. . . . 330 r.p.m.
- (d) Maximum temperature of cooling water for oil and air cooling systems, degrees C 25°
- (e) Diameter of clear working opening required in generator, meters sufficient to permit passage of generator lower bearing bracket but not less than 7.0M
- (f) Designed for operation with a turbine having the following dimensions and characteristics:
 - (1) Weight of turbine rotating parts and unbalanced hydraulic thrust, pounds 1,500,000#
 - (2) Diameter of turbine pit, meters, approximate. 7.0 m. (275-5/8")
 - (3) Elevation of turbine shaft coupling 58.2 m. (190.943')

- (4) Center to center spacing of turbine and future turbine,
meters 22.0 m. (72.178')

11. STRUCTURAL DETAILS

(a) The stator frame and lower bearing bracket of the unit will be supported on continuous base plates already in place. The generators shall be provided with bolts and dowels for fastening the stator frame and bearing bracket to the base plates, and for preserving the alignment between the generator frame and bearing bracket and the base plates. A liberal number of dowels shall be provided, in order to prevent any possible movement of the stator frame or bearing bracket on the base plates when the generator is subject to stresses resulting from the most severe short-circuit conditions. The stator shall be designed to permit the removal of the largest turbine part required to be passed through it when dis-assembling for repairs.

(b) The bracket supporting the thrust bearing shall have sufficient strength and rigidity to support the weight of the entire rotating element of the generator, together with the turbine runner and shaft, and the unbalanced hydraulic thrust of the turbine runner. If an upper guide bearing is used, the upper bearing bracket shall be designed so that it will not be necessary to remove the slip rings in order to remove the upper guide bearing. The lower bearing bracket shall be designed and constructed so that the bracket can be removed through the generator stator.

(c) The design of the generator brackets and structures in which resonance might become objectionable shall be so proportioned that any possibility of synchronism with the natural frequency, or

any of its multiples, of the turbine will be avoided. The Contractor will be advised as to the natural frequency of the turbine.

(d) Suitable platforms with stairs and handrailings shall be provided for the inspection of the exciters and the bearings.

(e) Suitable guards, over or around all live and moving parts, shall be provided. Guards for the shaft coupling flange will be furnished by the turbine manufacturer.

12. STATOR.

(a) The stator core shall be built in accordance with the latest modern practice and there shall be no objectionable buzzing of laminations during operation.

(b) The stator winding shall be star connected. Both ends of conductors of each phase shall be brought out within the generator housing and connected to nine differentially connected single secondary current transformers furnished by the Contractor and mounted at locations approved by the Engineer. These transformers shall be approved by the manufacturer of the differential relays whose name will be furnished later. Suitable mechanical shields shall be provided by the Contractor around the live parts to prevent injury to workmen while working on the surface air coolers while the generator is in operation.

(c) The stator winding shall be insulated with full Class B insulation as defined by A.S.A. Standards. The coils shall be form wound and interchangeable.

(d) Standard resistance-type temperature detectors shall be furnished as specified in paragraph 28.

13. ROTOR.

(a) The rotor shall be built in accordance with the best modern practice. The pole pieces shall be fastened to the rotor rim by means of accurately machined or die punched dovetails, matching similar slots in the rotor rim, and secured in place by means of tapered keys. The keys shall be locked in place on both sides of the rotor rim so as to prevent the keys from coming out in the event they should become loose. A suitable brake plate shall be provided on the rotor with which the brake shoes will make contact. The wearing surface of the brake plate shall be in segments which shall be readily removable and renewable. Adequate provision shall be made for dissipation of the heat resulting from the application of the brakes, and to take care of the expansion of the brake plate segments. The construction shall be such as to permit removal of the rotor assembly by withdrawing it from the shaft without disturbing the adjustment or setting of the lower guide bearing or thrust bearing.

(b) The entire rotor shall be designed to safely withstand the maximum runaway speed of 330 revolutions per minute.

(c) The field winding shall be insulated with Class B insulation in accordance with A.S.A. Standards. The windings and insulation shall be capable of withstanding all mechanical stresses to be imposed by the maximum runaway speed of the turbine, special care being used to prevent the end turns from deforming or slipping due to the centrifugal stresses on the interconnections.

(d) A damper winding shall be provided. The winding shall be of low resistance, rugged construction, without bolted joints, and

without connections between poles.

(e) Collector rings shall be above the rotor and shall be sufficiently spaced or barriered, and brushes so arranged as to minimize the possibility of an operator causing a short circuit between collector rings while changing or adjusting brushes. The brushes shall be staggered. The collector rings shall be so located that they will not interfere with the removal of the upper guide bearing. The leads from the collector rings shall run directly to the main exciter as no field switch, discharge resistor, or rheostat will be used in the generator field circuit. An extra set of collector ring brushes, brush holders, and terminals shall be provided for use with the field temperature indicator which will be furnished by others. Two 100 millivolt shunts shall be furnished and mounted in the generator field leads. Suitable leads shall be brought from the temperature indicator brush holders and from the field shunts to suitable terminal boards mounted on the stator frame in a location to be approved by the Engineer. Where possible, all leads shall be in rigid steel conduit.

(f) The WR^2 of the generator rotor, shaft, and exciter armatures shall be not less than 36,000,000 pounds feet squared. This value of WR^2 shall be incorporated into the rotating parts of the generator and exciters. A separate flywheel will not be permitted.

14. SHAFT

(a) The generator shaft shall be made of forged, open hearth carbon or alloy steel, properly heat-treated. It shall be of ample

size to operate safely at any speed up to and including the full run-away speed of the turbine without detrimental vibration or distortion.

(b) The generator shaft shall be of the proper length to connect with the turbine shaft and shall have a forged flanged male half-coupling on the lower end for connection to a similar half-coupling on the upper end of the turbine shaft. The face of the coupling shall be at elevation 58.2 meters with the sole plates as existing in the foundations as built.

(c) The generator shaft shall be accurately machined all over and polished at the bearing surfaces and at accessible points below or above each guide bearing for alignment checks. The shaft shall have a hole at least $14\frac{1}{2}$ inches in diameter bored axially throughout its entire length and machined sufficiently smooth to permit visual inspection of the metal in the interior of the shaft. All cylindrical portions of the shaft shall show not more than 0.0015 inch on the indicator, or 0.00075 inch from straight. Faces of coupling flanges shall show not more than 0.001 inch and thrust bearing faces shall show not more than 0.0015 inch on the indicator. The male portion of the generator shaft coupling shall show a run-out of not more than 0.001 inch on the indicator.

(d) The Contractor shall make such arrangements with the turbine manufacturer as may be necessary to provide a neat-appearing coupling and a satisfactory and accurate fit between the two halves of the coupling. The length of the male connection on the generator shaft will be approximately one inch. The generator shaft shall be provided with not less than three backing-out bolts in the coupling

flange, suitable for breaking the joint. The coupling bolts and nuts will be furnished by the turbine manufacturer and will be accurately finished for a light driving fit. A suitable guard for both halves of the coupling will be furnished by the turbine manufacturer. The generator manufacturer shall machine the generator shaft flange for the flange guard in accordance with drawings furnished by the turbine manufacturer.

15. SHAFT ALIGNMENT.

(a) The generator shaft will be fitted to the turbine shaft by the turbine manufacturer. The generator contractor shall deliver the generator shaft, completely machined, with coupling bolt holes drilled, and with the thrust blocks mounted thereon, f.o.b. cars at the turbine manufacturer's factory.

(b) The cylindrical guide bearing surfaces and the surface of the thrust bearing block of the assembled generator and turbine shafts shall, upon alignment tests at the factory, check out to the satisfaction of the Engineer, but in no case shall the cylindrical portions of the assembled generator and turbine shafts show more than 0.003 inch on the indicator, or 0.0015 inch from straight. The thrust block faces shall show not more than 0.0015 inch on the indicator.

(c) To insure accurate alignment of the turbine and generator shafts the generator shaft shall be shipped and loaned to the turbine contractor who shall ream the coupling bolt holes and test shaft section individually and then assemble the entire shaft on trunnion or vertically for alignment check, to be witnessed and approved in writing jointly by generator contractor and turbine contractor and the Purchaser or his engineer. Any corrections to the generator and turbine shaft shall be made immediately, the turbine and generator

Contractors cooperating to effect this so as to minimize any delays and adhere to the shipping schedules. The generator contractor shall provide a representative to supervise the loading of the generator shaft for shipment from the turbine factory.

16. BEARINGS

(a) The generator shall be provided with a General Electric spring type thrust bearing of the latest improved design, located below the rotor. The thrust bearing shall have ample capacity to support the combined weight of the rotating parts of the generator, exciters, and turbine, including the maximum unbalanced hydraulic thrust of the turbine runner. The weight to be included for the turbine runner, shaft and unbalanced thrust shall be 1,500,000 pounds. The bearing shall be capable of operating continuously under this load at any speed from half rated speed to 110 per cent rated speed; for at least one-half hour at 110 per cent rated speed to maximum runaway speed; and for at least one-half hour at a speed of 10 revolutions per minute. Starting at normal operating temperature, the bearing shall be capable of operating at normal speed and load with oil circulation maintained but without cooling water for at least 15 minutes, or with neither oil circulation nor cooling water for at least 10 minutes. The thrust bearing shall be arranged to permit adjustment, dismantling, and assembly without disturbing the rotor or stator, other than jacking the load from the bearing.

(b) The contractor shall provide a heat exchanger to be mounted at an agreed location external of the bearing pot, and to have sufficient capacity to maintain the oil, at the proper temperature with cooling water temperature at 25 degrees C with a minimum pressure of 20 pounds per square inch. The heat exchanger shall be

designed for safe operation at a maximum working pressure of 60 pounds per square inch and shall be subjected at the factory to a hydrostatic test pressure of 75 pounds per square inch, and its tubes shall be of corrosion resisting material. A water flow-indicator with alarm contacts shall be included in the water supply line as specified in paragraph 29. Companion flanges shall be furnished on the intake and outlet pipes.

All necessary oil piping, valves, fittings, one 380 volt, three phase A.C. motor driven pump, one 220 volt D.C. motor driven pump, complete with enclosed A.C. and D.C. starter panel containing all necessary magnetic switches for oil-pressure-failure and manual control of the A.C. and D.C. motors, for circulation of the oil through the exchanger, shall be included. The oil piping between the thrust bearing and the heat exchanger shall be of steel with welded fittings. The piping between different portions of the oil pumping unit itself shall be of steel with cast iron fittings. The Purchaser will supply and connect all water piping to the companion flanges supplied on the heat exchanger by the Contractor. The Purchaser will supply, as part of the governor actuator cabinet, the necessary manual control switches for control of the oil circulating pump motors; control voltage to be 230 volts D.C. for the magnetic starter panel.

(c) The generator shall be provided with one guide bearing located below the rotor. A second guide bearing shall be located above the rotor. The guide bearings shall be capable of withstanding all stresses incident to the normal operation of the unit and to the maximum runaway speed of the turbine. The guide bearings shall

be of the segmental, adjustable, babbitted type. The lower guide bearing shall be designed and constructed so that it can be dismantled without disturbing the thrust bearing or the generator rotor.

(d) Suitable platforms, stairs, and railings shall be provided where required for inspection or maintenance of the thrust and guide bearings.

(e) Resistance-type temperature detectors shall be provided in the bearings as specified in paragraph 28. Dial-type indicating thermometers and bearing temperature relays shall be provided as specified in paragraph 29.

17. LUBRICATION.

(a) The generator shall be provided with a complete self-contained lubricating system which shall include the latest improvements to eliminate the throwing of oil and the escape of oil vapor from the bearings and lubricating system. Adequate baffles shall be provided, if necessary, to prevent excessive churning or aeration of the oil. The lubricating system for the upper guide bearing, shall be separate from that of the lower one. Adequate and reliable means shall be provided for circulating the lubricating oil through each bearing.

(b) Each lubrication system shall include suitable oil reservoirs oil piping, necessary sight flow indicators, valves, and necessary appurtenances. One oil level gauge for each oil reservoir shall be furnished as specified in paragraph 29. All oil piping, valves, gauges, and fittings shall be of corrosion-resisting material. The Contractor shall furnish sufficient oil for the initial filling, plus 10% excess.

18. GENERATOR COOLING.

(a) The generator shall be provided with surface air coolers spaced around the periphery of the stator frame for a closed, re-circulating cooling system. The air coolers shall be of the straight tube type with corrosion-resisting, finned tubes expanded into corrosion-resisting tube sheets. The arrangement of tubes shall be such that any tube can be removed and replaced without disturbing any other tube. The water boxes shall be constructed with removable cover plates to permit access to all tubes for cleaning or inspection, without disturbing the water pipe connections. The inlet and outlet pipes shall have flanged connections. Provisions shall be made to permit complete draining of the coolers. Air vents shall be provided at the top of each cooler and elsewhere as required. Each air vent shall be connected through a valve to the discharge line. Lifting lugs shall be provided for removing each cooler through the top of the generator housing. Each cooler shall be tested at 75 pounds per square inch.

(b) The water headers shall be furnished by the Contractor and valves shall be provided in each connection between each cooler and the headers. The entire water system shall be designed to prevent excessive accumulation of sediment.

(c) For purpose of design, the maximum temperature of the water available for cooling shall be assumed to be 25 degrees C. and the minimum pressure at the cooler header shall be assumed to be 20 pounds per square inch. ^{1.41 kg/cm²} With cooling water supplied at the above temperature and pressure, the surface air coolers shall have sufficient cooling capacity to maintain the temperature of the air leaving

the coolers at 40 degrees C., or less, with the generator delivering continuously 115 percent rated output.

(d) The Contractor shall furnish all necessary metal duct and plate work for the cooling system.

19. GENERATOR HOUSING. A housing shall be furnished with the generator, of sufficient size to enclose and to provide access to the stator, coolers, piping, and all necessary electrical connections. The housing shall be made sufficiently rigid to prevent objectionable vibrations. A sufficient number of doors and other openings shall be provided to give easy access to each compartment in the generator housing. Flush locks, master-keyed, and necessary handles shall be provided on all access doors. Suitable fixtures, conduit, and wiring shall be provided for lighting the space between the generator frame and the generator housing, and the lighting system shall be switched near the access doors in a location approved by the Engineer.

The leads from the lighting system shall be brought to suitable terminal boxes, which shall be furnished by the Contractor. The design, construction, and architectural treatment of the housing shall be subject to the approval of the Engineer.

20. PIPING.

(a) All piping systems within the generator and housing, for the coolers, bearings, brakes, and water sprinkler pipes for fire protection, exclusive of nozzles, including ring headers for surface air coolers, valves and fittings, shall be designed, furnished, and fabricated by the Contractor with the connections to them brought out to positions adjacent to the generator housing or turbine pit,

as approved by the Engineer. Both water valves in the supply to the water sprinkler pipes, with necessary piping on the generator, shall be furnished by the Contractor. All piping shall be clean inside and, where ending in open connections for other work, ends shall be capped for protection. Valves and other operating devices shall be easily accessible, and gauges and other indicating devices shall be located where they can be conveniently read from floors or walkways.

(b) Pressure piping for brakes, and piping for air cooler supply and discharge headers may be of steel of appropriate strength, but other piping shall be of corrosion-resisting material. Water sprinkler piping and fittings shall be of corrosion-resisting material. Water piping, where dripping would be objectionable, shall be insulated to prevent sweating, and the insulation shall be protected by a substantial jacket, firmly secured in place. At all points where the piping system must be disconnected for dismantling operations, bolted flanged connections or unions shall be provided. Arrangement of piping and location of valves and joints shall be such that there will be minimum disturbance of piping and interference with other service when the generator is dismantled or parts removed for inspection or repairs.

21. BRAKES AND JACKS.

(a) The generator shall be provided with suitable air-operated brakes of sufficient capacity to bring the rotating parts of the generator and turbine to a stop from one-half normal operating speed within seven and one-half minutes after the brakes are applied, without injurious heating of the braking surface on the rotor, without field excitation on the generator, and with leakage through the tur-

bine gates not exceeding an amount which will produce 1 percent of the full rated generator torque. The air brakes shall be designed for operation with air pressure at 100 pounds per square inch. The brakes shall also be designed to serve as hydraulic jacks to lift the generator rotor and the turbine runner for removal or adjustment of the thrust bearing. This lift shall be sufficient to permit easy inspection or removal of the thrust bearing, and all parts of the generator shall be so constructed as to permit this lift without dismantling or disconnecting any parts. The turbine will be designed to permit a lift of not less than $1/4$ inch nor more than $5/16$ inch for this purpose. An approved provision shall be made for blocking the rotor in the fully raised position.

(b) A loop header for oil and air supply shall be provided and arranged to drain the oil and to prevent oil entry into the air system. High pressure valves shall be provided in the oil and air supply lines to the loop header. All piping used in connection with the air brakes and hydraulic jacks shall be furnished to a point below the lower bearing bracket, and shall be capable of withstanding the maximum oil pressure required to lift the combined weight of the rotating parts of the generator and turbine. The brake shoes shall be provided with suitable moulded asbestos friction wearing surfaces which shall be renewable. The brake shoes and wearing surfaces shall be keyed or otherwise securely fastened to the jack pistons.

(c) Control equipment for automatic and manual admission to and release of air from the operating cylinders of the brakes will be supplied by the turbine contractor.

(d) A portable, hand operated, high pressure oil pump, for use with the hydraulic jacks, shall be furnished with the generator by the contractor.

22. EXCITERS.

(a) The generator shall be provided with a direct-connected, shunt wound, separately-excited main exciter mounted above the generator, and a direct-connected, compound wound, self-excited pilot exciter mounted above the main exciter. The method of mounting the exciters shall be such that either the armature or the field of either exciter can be readily removed and replaced by a spare part.

(b) The armature and field windings of both the main and pilot exciters shall be insulated with Class A insulation as defined by A.S.A. Standards.

(c) The main exciter shall be designed for operation with the armature leads connected directly to the generator field collector ring brushes, and in connection with an automatic voltage regulator. The main and pilot exciters shall be designed to operate safely at the maximum runaway speed of the turbine. The commutation shall be practically sparkless from no-load to 150 percent of rated full-load current, as defined by A.S.A. Standards. Provision shall be made on the exciter brackets for mounting of the Kaplan head which will be furnished by others.

(d) A suitable shunt mounted on the field control panel specified in paragraph 23(b) shall be provided in the main exciter field circuit for use with a field ammeter to be furnished by others.

(e) Lights shall be provided with the main and pilot exciter

frames to facilitate inspection. They shall be arranged to prevent the possibility of dropping lamp parts into the machine. The Circuit shall be suitably switched in the vicinity of the exciter walkway at a location approved by the Engineer, and the leads carried to suitable terminal blocks located within the generator housing.

23. VOLTAGE REGULATOR.

(a) An automatic voltage regulator of the latest improved high speed type, responsive to average 3 phase voltage, complete with all necessary relays, cross-current and line-drop compensators, transfer switches, current transformer, and all auxiliary appurtenances designed for use with high speed response excitation shall be furnished with the generator, together with all voltage regulator apparatus required for satisfactory operation of the generator in parallel with existing generators. The voltage regulator, together with the generator excitation system, shall be capable of responding to changes in the alternating current voltage in a period of 5 cycles. It shall function without hunting and shall prevent a dangerous rise in the generator and main and pilot exciter voltages at runaway speeds. It shall control the generator voltage so as to increase the safe operating limit and tend to improve stability of the generating and transmission system and minimize the effects of disturbance caused by short-circuits or sudden load changes. The Contractor shall furnish all transfer switches, control switches, indicating lights to show contact points, hand-operated voltage adjusting rheostat, flush mounting main control element, and all other required parts for the regulator system, including those that mount on the main switchboards. Complete wiring diagrams and dimension

drawings for same shall be furnished. Parts to be mounted on switchboards furnished by others shall match the parts with which they are to be associated and, if so ordered by the Engineer, shall be shipped to the switchboard manufacturer for mounting.

(b) A main exciter motor-operated field rheostat shall be furnished with the regulator, and shall be arranged for remote operation from the main switchboard by the regulator and by a manually operated switch. It shall have at least four steps of fixed resistance for adjustment for any variation between calculated and tested values of exciter saturation curves. It shall be designed to reduce the voltage of the main exciter to practically zero at rated speed and rated pilot exciter voltage. All relays, control switches, and other appurtenances required for the regulator, but not mounted on the main switchboards, shall be furnished and mounted on the face of the main exciter rheostat, or on a suitable panel adjacent thereto. This panel shall match in appearance the face of the rheostat as nearly as practicable. A remote controlled main exciter field breaker, and a pilot exciter voltmeter shall be furnished and mounted on the above-mentioned panel. The main exciter field circuit breaker with field discharge resistor shall be remotely controlled and operated from 250 volt direct current. The breaker shall be of the dead-front type rated not less than the maximum continuous current of the circuit under any of the specified operating conditions of the generator. The operating mechanism shall be trip free in all positions. A manual operating handle shall be provided, extending through a panel opening for operation from the front of the panel.

(c) The manually-operated pilot exciter field rheostat shall

be furnished and arranged with bracket, shaft, and handwheel for back of switchboard mounting. A supplementary block of resistance with necessary contactors and suitable relays shall be provided to keep the pilot exciter voltage within safe limits when the pilot exciter is operating at the maximum runaway speed of the turbine. Terminal blocks shall be provided for all wiring external to the regulator.

24. PERMANENT MAGNET GENERATOR AND TACHOMETER. The governor contractor will furnish a permanent magnet generator, for driving the governor and an approved overspeed switch for the main generator. The generator manufacturer shall cooperate to provide proper mounting for these parts and shall furnish and install the wiring therefor to approved terminal blocks in the base of the stator at a location approved by the Engineer.

25. HEATERS. The Contractor shall install not less than 20 kilowatts of electric heaters, in 2 or 3 kilowatt units, designed and located so as to prevent condensation on the windings when the machine is idle. Rigid galvanized steel conduit shall be used for the connection between individual heaters and the heater circuit terminal box, which shall be furnished and located within the generator housing at a point approved by the Engineer. Wire shall be stranded, insulated with varnish cambric, an outer belt of asbestos, and a suitable protective braid.

26. ACCESSORY LEADS. Leads within the generator and housing, including leads for excitation, control, heaters, overspeed switch, governor drive generator, and other accessories shall be furnished. Leads which extend beyond the generator shall terminate in conveniently located connection boxes provided with terminal blocks.

Conduits shall be arranged, as far as practicable, to make removal unnecessary when the generator is dismantled. Terminal boards for connection of wiring from outside the generator shall be located as approved by the Engineer. All small wires shall be flexible, asbestos-varnished cambric or Flamenol insulated, and not smaller than No. 19/25 except for leads for resistance temperature detectors, which shall be the Contractor's standard 3-conductor resistance temperature detector cable, each conductor of which has 16 strands of 0.0126 inch copper and is approximately equivalent to No. 16 wire. Cable lead markers shall be furnished to agree with the terminal board numbers.

27. INSULATION AGAINST STRAY CURRENTS. The generator shall be adequately insulated against stray currents which may be set up by the field of the generator and which may cause injury to the generator or turbine bearings. This insulation shall be arranged to break the possible path of such currents in not less than two places in series so that positive tests for ground currents can readily be made.

28. TEMPERATURE DETECTORS. Standard resistance-type temperature detectors of approximately 10 ohms at 25 degrees C. shall be furnished and installed as follows:

"Total Quantity	Location
12	Generator stator winding, located in accordance with ASA rule C50-3.080.
2	One in each half of thrust bearing.
2	Thrust bearing oil reservoir.
4	Two in each guide-bearing, located diametrically opposite.
8	One for each surface air-cooler discharge."

Wiring from these detectors shall be installed as far as practicable before shipment, and sufficient conduit and wires shall be furnished to carry all temperature leads to terminal blocks furnished and installed by this Contractor at locations within the generator housing approved by the Engineers. The cable and wiring between the terminal blocks and the temperature indicator or recorder will be furnished and installed by others. The temperature indicator or recorder will be furnished by others.

29. INSTRUMENTS AND GAUGES. The following instruments and gauges shall be furnished with the generator by the Contractor.

(a) One vapor-tension dial type indicating thermometer with adjustable alarm contacts, in the thrust bearing, one in the thrust bearing oil reservoir, and one in each guide bearing. They shall be located so as to indicate the temperatures of the hottest parts. The thermometers will be mounted on the governor actuator cabinet by others and an adequate length of tubing shall be provided with each thermometer. The bulb and tubing shall be insulated where necessary to prevent bearing currents.

(b) One pneumatic bearing temperature relay similar and equal to General Electric Co., type TB-2, located in the babbitt of the thrust bearing and each guide bearing. The relays shall close a pair of contacts when the bearing temperature reaches approximately 105 degrees C. The contacts shall have a current carrying capacity of not less than 5 amperes and shall be suitable for 250 volts D.C. The relays shall be mounted in an approved location and the leads brought to a terminal board located on the stator frame in a position approved by the Engineer. The tubing

shall be insulated where necessary to prevent bearing currents.

(c) One oil level gauge, for each oil reservoir, of sufficient length to indicate the oil level at all room and operating temperatures. The gauges shall be located on the side of the reservoirs in an accessible location approved by the Engineer. Each oil level gauge shall have high and low oil level alarm contacts suitable for 250 volts D.C. The Contractor shall also supply a 110 volt, 50 cycle Selsyn type thrust bearing oil level transmitter and receiver. The indicating receiver will be mounted by Woodward Governor Company on their actuator cabinet.

(d) One water flow indicator, with alarm contacts suitable for 250 volts D.C., located in the thrust bearing cooling coil supply line.

(e) One pilot exciter voltmeter with suitable scale, located on the voltage regulator rheostat panel.

(f) Two 100 millivolt shunts mounted in the generator field leads.

(g) One suitable shunt mounted on the field control panel specified in paragraph 23(b) in the main exciter field leads, for exciter field ammeter to be furnished by others.

30. FACTORY ASSEMBLY AND TESTS.

(a) Complete assembly of the main generator at the factory will not be required. The insulation between turns of the stator coils shall be tested at the factory by impressing an alternating potential at suitable frequency across each coil so as to produce a voltage of not less than 10 times normal operating voltage between adjacent turns. The insulation between turns of the field coils of

the main generator shall be similarly tested so as to produce a voltage of 40 volts between adjacent turns.

(b) The main exciter and pilot exciter shall be completely assembled at the factory and each exciter shall be subjected to a standard short commercial test, including but not restricted to the following:

- (1) Dielectric tests on the windings in accordance with A.S.A. Standards.
- (2) Measurements of resistance of the armature and field windings.
- (3) Tests to determine the open circuit saturation curve.
- (4) Tooth ripple voltage tests, main exciter only.
- (5) Heat run to determine the temperature rise after continuous output at rated full load.
- (6) Test to determine losses and efficiency.
- (7) Test to determine the regulation curve.
- (8) Test to determine overload commutation.
- (9) Test to determine speed of response, main exciter only.
- (10) Test to determine ceiling voltage, main exciter only.

(c) The tests on the exciters shall be conducted in accordance with A. S. A. Standards. Should the results of the tests show the failure of any equipment or part to meet any of the Contractor's guarantees, or to comply with the requirements of the specifications or of appropriate standards, the Contractor shall make such changes, alterations or replacements, and repeat such tests as are necessary to demonstrate the fulfillment of all guarantees, requirements, and standards. The Contractor shall notify the Engineer as far in

advance as practicable when each machine will be ready for tests so that the tests may be witnessed by the Engineer's representative. The contractor shall furnish the Engineer with 4 certified copies of the results of the tests.

(d) Four copies of the following curves and data showing the characteristics of the exciters as determined by the factory tests shall be furnished:

- (1) Efficiency, plotted against amperes output at rated voltage.
- (2) Efficiency, plotted against amperes output through a fixed resistance equal to the calculated resistance of the main generator field winding at 75°C.
- (3) Armature copper loss, plotted against amperes output.
- (4) Field copper loss, plotted against amperes output.
- (5) Core and stray losses, plotted against amperes output.
- (6) Total losses, plotted against amperes output.
- (7) Total losses, plotted against amperes output through a fixed resistance equal to the calculated resistance of the main generator field winding at 75°C.
- (8) Saturation open circuit volts, plotted against field amperes.
- (9) Regulation, volts plotted against amperes output.
- (10) Calculated voltage rise at runaway speed.

(e) All other electrical parts, such as regulator rheostats and similar devices shall be tested individually in accordance with applicable A.S.A. or A.I.E.E. Standards, except that where the parts are in quantity production and routine tests are made, and such

routine tests are in accordance with A.S.A. or A.I.E.E. Standards, individual tests of such parts will not be required; however, in either event the Contractor shall submit certified test data covering each part.

(f) All oil and air coolers shall be subjected to a static water pressure of 75 pounds per square inch, for a period of not less than one hour without showing leaks. Four copies of the certified test report shall be furnished the Engineer.

(g) The waiver of any test, or the witnessing thereof by the Engineer, shall not constitute a release of the Contractor's responsibility to fully meet the requirements of the specifications,

31. FIELD ERECTION. The Contractor shall furnish supervision during erection and be responsible for the following:

(a) Furnishing all special tools and equipment required during erection.

(b) Furnishing drawings with sufficient detail to enable others to install the holding down bolts,

(c) Supervising erection of all generator parts and appurtenances.

(d) Supervising aligning the generator with reference to the turbine.

(e) Dynamically balancing the generator rotor and making all adjustments required for the same so that the generator will operate under any normal load conditions without detrimental vibrations or objectionable noises.

32. FIELD TESTS.

(a) After the generator and auxiliary equipment have been

installed in the power plant ready for operation, the generator shall be tested by and at the expense of the Purchaser to determine whether the Contractor's guarantee and the requirements of these specifications have been fulfilled, and to furnish information that may be needed in using the generator as a dynamometer during the testing of the turbine. The tests shall be made in accordance with the applicable requirements of A.S.A. Standards, the A.I.E.E. "Preliminary Report on a Proposed Test Code for Synchronous Machines", dated January 1937, and the A.S.M.E. "Test Code for Hydraulic Prime Movers", dated June 1938, except as herein definitely stated. The waiver of any test shall not relieve the Contractor of his responsibility to fully meet the requirements of the specifications. All tests shall be witnessed by a representative of the generator manufacturer.

(b) The following tests will be made:

- (1) Dielectric Test of armature and field windings.
- (2) Resistance of armature and field windings.
- (3) No-load saturation test.
- (4) Short Circuit saturation test
- (5) Telephone interference factor determination.

(6) Short circuit test to demonstrate that the generator is capable of withstanding short circuit stresses without injury when the machine is operating under rated load. This test shall be made by abruptly short circuiting the generator when operating at no-load, rated frequency and 10 per cent above rated voltage for a period of not more than 30 seconds. One of the "current waves, when taken on an oscillograph, shall be practically completely offset.

If the first short circuit does not produce this, additional short circuits shall be applied until such is obtained.

(7) Conventional efficiency test: This test shall include the determination of I^2R losses in armature and field windings, friction and windage losses, core losses, stray load losses, and miscellaneous losses.

(8) Heat run to determine the temperature rise of the various parts of the generator when operating continuously at full rated output. Load will be provided at the expense of the Purchaser.

(9) Test to determine direct axis transient reactance.

(10) Test to determine negative sequence reactance.

(11) Test to determine zero sequence reactance.

(12) Deviation factor of wave form; Oscillograms shall be taken of the wave form of the voltage of each phase of the armature winding when the generator is operating at normal rated voltage at no load.

(13) Determination of time for brakes to stop the machine from one-half speed with driving torque reduced to 1% of rating and with main exciter field open.

(14) Test to determine the short-circuit ratio.

(15) High potential test of all parts not completely assembled and tested in the shop.

(16) The main exciter rheostat shall be tested as to time for rheostat to make full travel. The pilot exciter rheostat or resistor shall be tested to determine the sufficiency of the field-reducing resistance to keep the voltage of the pilot exciter within safe limits when the unit is operating at runaway speed.

(17) Runaway speed test at 330 r.p.m.

(18) The voltage regulator shall be tested and adjusted to determine sensitivity and response.

(19) Test for the determination of quantities and temperature of ingoing and outgoing cooling water for bearings and for air coolers.

33. GENERAL CONSIDERATIONS.

(a) All equipment shall be designed for shipping as per limitations shown on drawing 55-00, dated August 21, 1942. The maximum weight of any individual item shall be 55 metric tons. A special drop center or well car is on hand for use in carrying the heavy parts; and dimensions of this car are shown on drawing 55-00. The Contractor will be required to keep the loaded car within the limits shown.

(b) All auxiliary devices on the generator unit that require A.C. power shall be suitable for operation from the Purchaser's 220/380 volt, 3 phase, 4 wire, 50 cycle auxiliary power supply, unless otherwise specified.

